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**Sports, exercise and health science**  
**Higher level**  
**Paper 2**

26 October 2023

**Zone A** afternoon | **Zone B** afternoon | **Zone C** afternoon

Candidate session number

2 hours 15 minutes

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**Instructions to candidates**

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer two questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[90 marks]**.

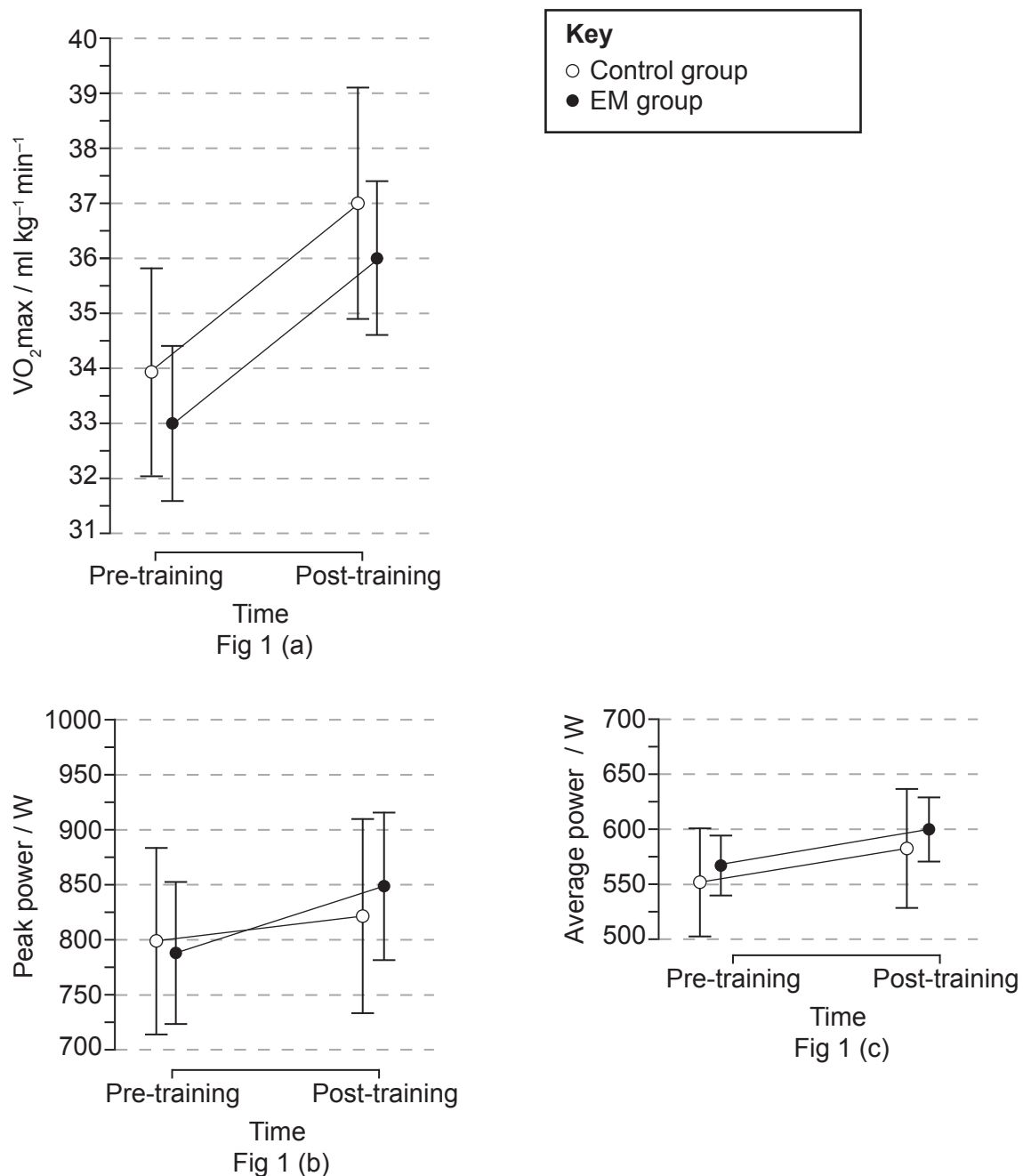


## Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

1. A study investigated the performance of cyclists in  $\text{VO}_2\text{max}$  and peak power tests after performing high-intensity interval training (HIIT) for four weeks. One group completed the training while wearing an elevation mask (EM). A different control group completed the same training without the use of a mask. EMs are designed to simulate oxygen levels that would be experienced at higher altitudes. Results (mean and standard deviation) pre- and post-training for the tests are shown in **Figure 1**.

**Figure 1: (a)  $\text{VO}_2\text{max}$ , (b) peak power, and (c) average power for individual tests**



(This question continues on the following page)



(Question 1 continued)

- (a) State the peak power, in W, for the EM group post-training. [1]

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.....

- (b) Calculate the mean change in  $\text{VO}_2\text{max}$ , in  $\text{ml kg}^{-1} \text{min}^{-1}$ , for the EM group from pre-training to post-training. [1]

.....  
.....

- (c) The coefficient of variation is the ratio of the standard deviation to the mean expressed as a percentage. Compare and contrast the coefficients of variation of the data represented in **Figure 1**. [2]

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- (d) With reference to **Figure 1(b)** and **Figure 1(c)**, compare and contrast the reliability of the results for the peak power and average power data. [2]

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**(Question 1 continued)**

- (e) Deduce the effect of wearing an EM on the cyclists' performance in the tests. [3]

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- (f) (i) State why randomization was used to assign participants to the EM and control groups. [1]

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- (ii) Outline the importance of using control groups to compare data before and after intervention. [2]

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2. (a) State the role of the immune system in maintaining the health of an athlete. [1]

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- (b) An elite endurance athlete has planned a high volume of intense training during a cold winter. Outline **two** of the athlete's immune responses to this prolonged period of training. [2]

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3. An 18-year-old female is training for a 10 km race.

- (a) Outline **one** role of the brain stem and **one** role of the diencephalon during a training session.

[2]

.....

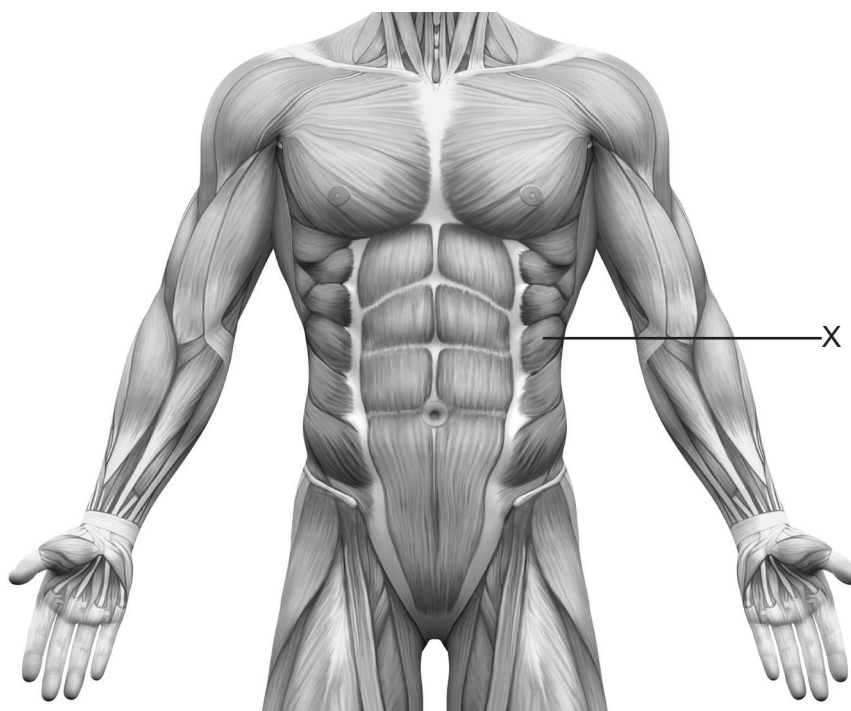
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- (b) Identify the muscle group X.

[1]



X .....

.....

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**(Question 3 continued)**

- (c) Explain the role of ventilatory muscles during inspiration when running a 10 km race. [4]

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- (d) Distinguish between the recommended carbohydrate intake of a trained 10 km runner and a sedentary individual. [1]

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- (e) Insulin and exercise regulate muscle glucose levels. Explain the role of muscular contraction on muscle glucose uptake during a run. [4]

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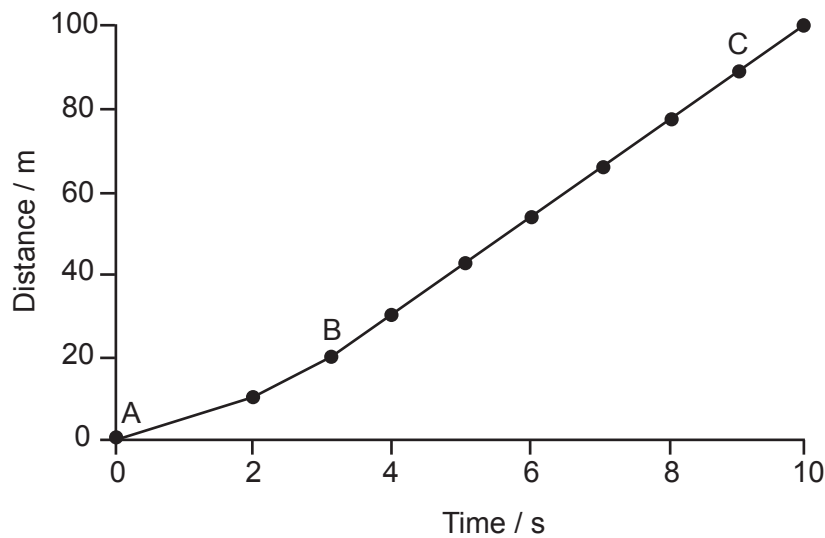
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4. The diagram shows a distance–time graph for a 100 m sprinter.



- (a) Analyse the graph between

- (i) A–B.

[1]

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 .....

- (ii) B–C.

[1]

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 .....

- (b) Compare and contrast the feedback loops involved in motor programmes for a novice and an experienced gymnast.

[3]

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**(Question 4 continued)**

(c) Outline how exercising outside can increase an athlete's vitamin D levels.

[2]

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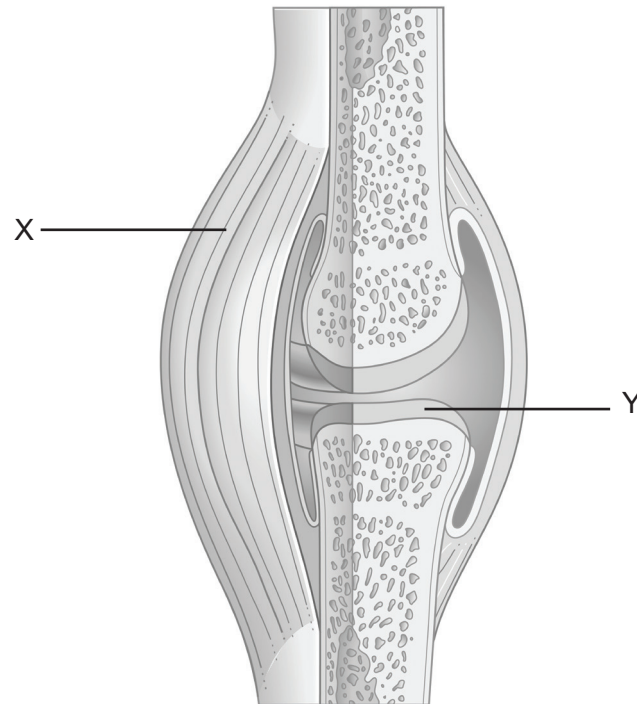


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Answers written on this page  
will not be marked.



5. The diagram shows a synovial joint.



- (a) Annotate the structures X and Y in the synovial joint.

[4]

|   | Structure | Annotation |
|---|-----------|------------|
| X | .....     | .....      |
|   | .....     | .....      |
| Y | .....     | .....      |
|   | .....     | .....      |

- (b) Using named muscles, analyse how muscles work in pairs to coordinate knee extension when kicking a ball.

[2]

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6. (a) Apply the following components of fitness to a sport of your choice:

(i) Flexibility

[1]

.....  
.....

(ii) Speed

[1]

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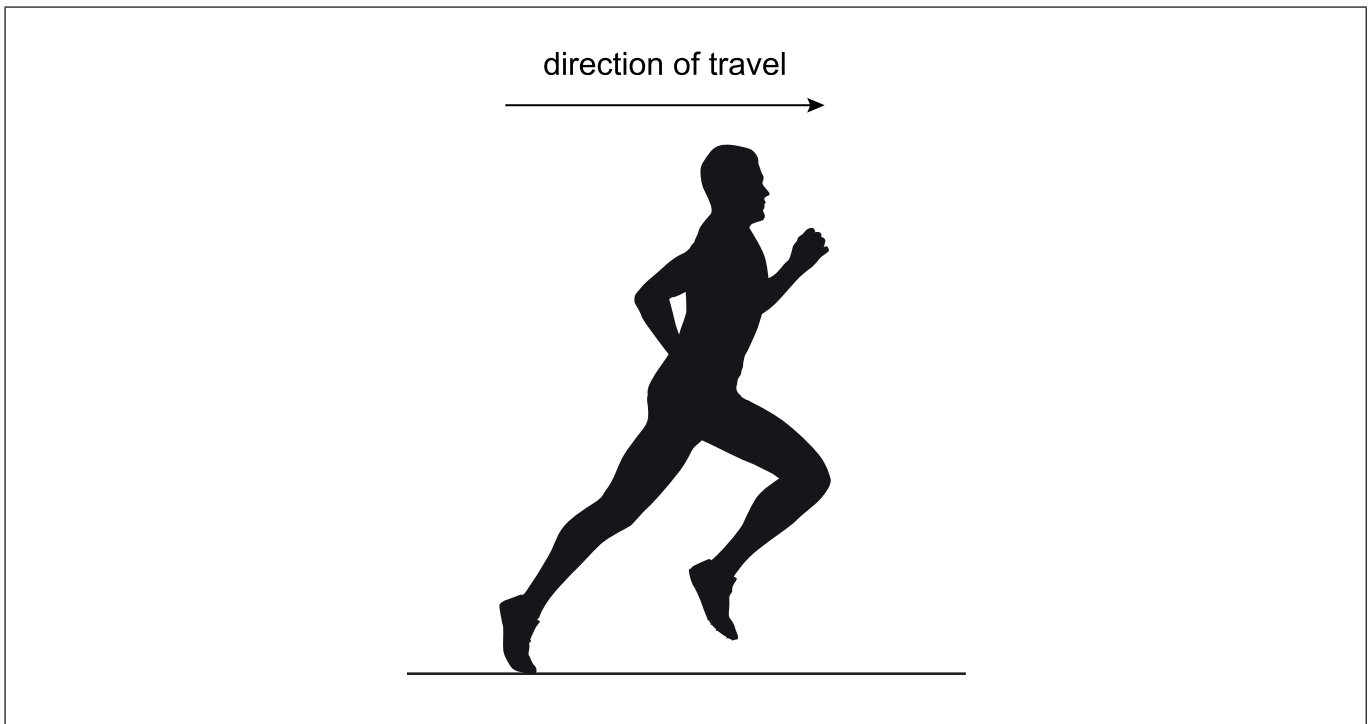
(iii) Muscular endurance

[1]

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(b) Label the diagram to show the relevant forces acting on a person running at constant velocity.

[4]



(This question continues on the following page)



(Question 6 continued)

(c) Suggest **three** performance and health benefits of genetic screening for athletes.

[3]

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## Section B

Answer **two** questions. Answers must be written within the answer boxes provided.

7. (a) Apply the phase analysis model to a penalty kick in soccer. [4]
- (b) Discuss the contribution of environmental factors to the performance of an elite weightlifter. [4]
- (c) Explain gaseous exchange at the alveoli in a cyclist competing in a road race. [6]
- (d) Outline the pathway of a red blood cell once it is saturated with oxygen in the pulmonary capillary and arrives at the capillaries of the systemic system. [6]
  
8. (a) The brain predominantly receives energy through aerobic respiration. Describe the challenge of supplying energy to the brain cells. [3]
- (b) During a period of recovery, the body repairs and builds tissues. Explain how the hypothalamus regulates the pituitary gland. [6]
- (c) Explain how a rugby player can change the position of their centre of mass to increase their stability as they prepare to make a tackle. [5]
- (d) An athlete runs a 400 metre race in 60 seconds. Describe the re-synthesis of ATP during this race. [6]
  
9. (a) Outline **four** strategies an athlete can adopt while training from home to minimize their risk of infection. [4]
- (b) Using examples, suggest how a coach can use task and environmental constraints to introduce field hockey to young novice players. [5]
- (c) The image shows a biathlete rifle shooting at a stationary target during a biathlon. A biathlon involves shooting at targets at multiple locations along a cross-country skiing course.



- (a) Apply the skill classification continuum to one rifle shot performed by a biathlete. [5]
- (d) Evaluate the use of Cooper's 12-minute run test to assess the fitness of a soccer team. [6]



10. (a) Distinguish the function of the predominant muscle fibres in the quadriceps of an elite marathon runner and a 100 m sprinter. [5]
- (b) Outline how surface and wave drag affect the performance of a swimmer and how they can be reduced. [4]
- (c) Discuss the factors affecting fatigue during 100 m sprint training. [5]
- (d) An athletics coach is teaching a group of novices how to perform long jump. Explain how the coach could present the skill using **two** different methods. [6]













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#### References:

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6. Msan10, n.d., *Running men, set of vector silhouettes, group of people - stock illustration*. [image online] Available at: <https://www.gettyimages.co.uk/detail/illustration/running-men-set-of-vector-silhouettes-group-royalty-free-illustration/1300502602> [Accessed 21 April 2023].
9. Technotr, n.d. *Young women shooting during biathlon competition - stock photo*. [image online] Available at: <https://www.gettyimages.co.uk/detail/photo/young-women-shooting-during-biathlon-competition-royalty-free-image/185090207?phrase=young+woman+shooting+during+biathlon&adppopup=true> [Accessed 21 April 2023].

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